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Waterfowl Harvest on Keokuk Pool, Mississippi River, 1969 and 1970

Stephen Douglas Wilds
Iowa State University

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STEPHEN DOUGLAS WILDS[1]

SYNOPSIS: Waterfowl harvest on Keokuk Pool, Mississippi River, 1969 and 1970. *Proc. Iowa Acad. Sci.*, 79(2):79-84, 1972. This study was conducted during the autumns of 1969 and 1970 to gain insight into the effects of hunting on the large waterfowl population of the Keokuk Pool. Objectives of the project were to determine: (1) species composition of the harvest, (2) chronology of the kill, (3) significance of the "bonus" scaup season, and (4) species selectivity by hunters. Daily hunting record sheets were maintained by cooperating hunters and provided most of the harvest data. Bag checks and hunting party observations yielded additional information. Over 3,788 man-days were spent hunting waterfowl on the Keokuk Pool in 1970. Approximately 8,700 waterfowl were harvested in 1970 and about 7,100 birds were taken in 1969.

Hunting kill has little effect on the waterfowl using the area. Mallards and scaup make up over 50 percent of the kill on the Keokuk Pool. Canvasbacks are only lightly harvested in proportion to the number which use the pool.

INDEX DESCRIPTORS: Waterfowl harvest, Mallard harvest, Scaup Duck Harvest.

The Keokuk Pool, or Pool 19, of the Mississippi River extends from Keokuk, Iowa to Lock and Dam No. 18 above Burlington, Iowa. The lower half of the pool is of major importance as a resting area for migrating diving ducks in both fall and spring. The principal species which use the area are lesser scaup (*Aythya affinis*) (bird names from A.O.U. check-list, 1957), canvasback (*Aythya valisineria*), ring-necked duck (*Aythya collaris*), and common goldeneye (*Bucephala clangula*). Previous studies have shown that the area receives 20 million diving duck-days use per year (Thompson, 1969).

A conflict of interest has arisen during the past 20 years between industry and conservationists over the use of the Keokuk Pool. A proposed dredging project in the Fort Madison, Iowa area initially aroused concern over the possible effects such a disturbance might have on the animal life associated with the pool. In addition to the possible effects of dredging, there is the likelihood that resultant industrialization may increase pollution which may reduce or exterminate the fingernail clam (*Sphaerium transversum*) as it did in the Illinois River (Mills, Starrett, and Bellrose, 1966). Thompson (1969) demonstrated the high level of utilization of clams and other benthic organisms by diving ducks. If the food resources are destroyed, use of the Keokuk Pool as a rest area during migration would be eliminated.

These concerns prompted several studies of waterfowl resources on this segment of the Mississippi by students at Iowa State University in cooperation with the Iowa State Conservation Commission. Because of the hunting pressure and the high duck population on the Keokuk Pool, it was felt that more should be known about waterfowl harvest on the area. Objectives of the project were to determine: (1) species composition of the harvest, (2) chronology of the kill, (3) significance of the "bonus" scaup season, and (4) species selectivity by hunters.

Field work was conducted during September through December, 1969 and September through November, 1970. The research was done under Pittman-Robertson Projects W-108 R and W-113 R of the Iowa State Conservation Commission.

[1] Department of Zoology and Entomology, Iowa State University, Ames, Iowa.

THE STUDY AREA

After purchasing most of the land which was to be inundated, the Mississippi River Power Company built the dam at Keokuk, Iowa during the period of January, 1911 to June, 1913 (Coker, 1914). This created an impoundment approximately 45 miles long and up to two miles wide. Previous investigators have used the lower 26 miles of the Keokuk Pool as a study area, and detailed descriptions were given by Jude (1968), Thompson (1969) and Gale (1969).

The study area was subdivided by Thompson (1969) into lower, middle, and upper sections. The lower section extends from the dam to Nauvoo, Illinois. The portion of the river between Nauvoo and the bridge at Fort Madison comprises the middle section. The upper section includes that part of the river between the Fort Madison bridge and the Ideal Hunting Club upstream from Dallas City, Illinois.

The lower section is approximately 12 miles long and averages one mile in width. This segment has a mean depth of 10.8 feet (Thompson, 1969). Little vegetation is found except for a large stand of American lotus (*Nelumbo lutea*) in the backwaters near Nauvoo. There is less disturbance in this portion of the river than in other areas.

The middle section of the study area differs considerably from the lower section. It is eight miles long and up to two miles wide. This portion of the study area has large expanses of water less than seven feet deep. More backwaters exist in the middle than in the lower section. Diving duck food is abundant in the open water of this segment (Thornburg, 1970). High populations of fingernail clams and some submergent plant growth provide food for diving ducks using the area. Human disturbance is great in the middle section because the shallow water facilitates building of blinds, and hunting pressure is heavy. Ducks are forced by boat traffic and hunting pressure to sit in deep water near the channel and frequently are flushed by passing barges.

The upper section of the study area is narrower and two miles shorter than the middle section but is nearly as deep as the lower section. There are six islands in this portion of the river, and all are leased by hunters. The backwaters around the islands attract considerable hunting pressure. Dabbling duck habitat is good in the lotus beds near the islands. Thornburg (1970) reported one of the highest fingernail clam populations on the Keokuk Pool to be in the Dallas City area.

Hunting and barge traffic are major disturbance factors on the upper section. As in the middle section, ducks often are flushed by barges.

METHODS

Determination of the chronology of the waterfowl migration was made from information provided by Frank C. Bellrose of the Illinois Natural History Survey. Bellrose's population figures were used because it was felt that his extensive experience in aerial censusing of waterfowl on the Mississippi River provided the most accurate population data available.

Migration data were compared with kill data to correlate harvest and population fluctuations.

Daily hunting record sheets were the primary means of collecting data on waterfowl harvest. Hunters were contacted and asked to participate in the study. Each cooperator was given a daily hunting record sheet which consisted of a listing of the waterfowl species normally bagged on the Keokuk Pool and a column for each day of the season. Hunters were asked to record in the appropriate column the number of each species shot each day. Records were collected from the hunters after the season closed.

Two other techniques were used to gain additional information on harvest. Bag checks were made whenever a hunting party was contacted, and observation of hunting parties was attempted in an effort to gain insight into the accuracy of hunters in reporting their kill on the hunting records. Both of these methods were useful in assessing the selectivity of hunters in taking certain species of ducks.

Data analysis consisted of summarizing the kill by species and estimating total harvest. The kill for each species during each week of the hunting season was plotted to determine chronology of the harvest. An average kill per blind also was determined. Assuming that the hunters who participated in this study were typical of all hunters on the study area, the average kill per blind was multiplied by the number of blinds on the area to estimate total bag for the area for the season.

During a 1949-1952 study of crippling loss along the Illinois side of the Mississippi River, George Arthur (in Bellrose, 1953) found that hunters hunting on private clubs and shooting predominantly mallards and diving ducks over open water failed to retrieve 21 percent of the ducks they knocked down. Thus, birds in the bag represented only 79 percent of the estimated total kill. Because of the similarity of conditions between Arthur's study and mine, I applied his figure to the estimated total bag on the study area to arrive at a total kill.

RESULTS

Fall Waterfowl Populations

Waterfowl numbers on the Keokuk Pool were substantially lower in 1970 than in 1969. The peak population in 1969 was 948,500 waterfowl on November 5. In 1970 the greatest number of birds on the study area was 242,585 on November 17. The most abundant species, the lesser scaup, was greatly reduced in 1970, but the reason for this reduction is unknown. In both years the highest count of scaup using the pool was obtained on November 5: 670,000 in 1969 and 195,000 in 1970. Canvasback numbers were up in 1970 with a peak of 168,000 compared to a maximum of 148,500 in

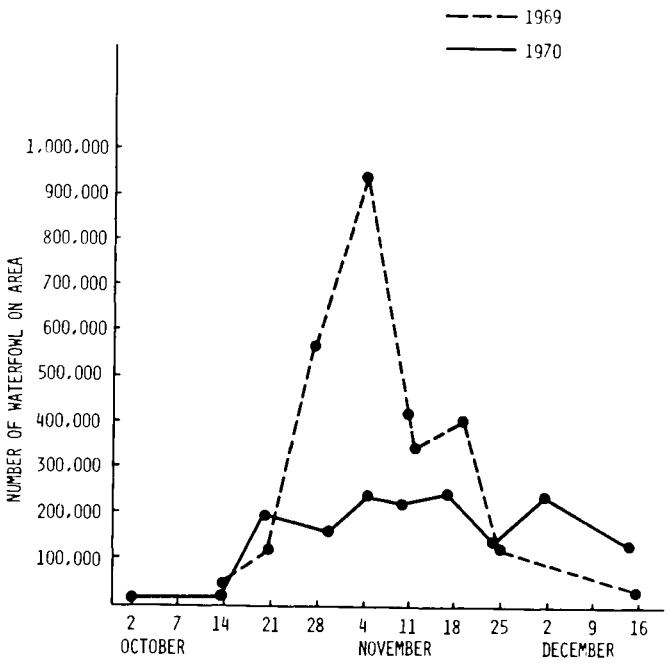

Figure 1. Number of waterfowl using Keokuk Pool in 1969 and 1970.

1969. The peak canvasback population in 1969 occurred on November 20, but in 1970 the maximum number of canvasbacks was not reached until December 2. Figure 1 illustrates fall waterfowl populations on the Keokuk Pool for both years of this study.

Thompson (1969) reported total waterfowl-days on the Keokuk Pool for three different seasons (Table 1). One waterfowl-day equals one bird on the study area for one day. Waterfowl-days on the study area for fall, 1969, totaled 19,178,160. This was the highest number of waterfowl-days ever recorded on the area for a single season.

TABLE I. NUMBER OF WATERFOWL-DAYS ON THE KEOKUK POOL

	Date	Number of waterfowl-days
Spring, 1967	(Mar. 3-April 19)	11,182,915
Fall, 1966	(Oct. 17-Dec. 24)	11,196,820
Fall, 1967	(Oct. 17-Dec. 11)	9,498,330
Fall, 1969	(Oct. 14-Dec. 16)	19,178,160
Fall, 1970	(Oct. 2-Dec. 15)	11,974,230
Fall average		12,961,997

Chronology of Migration

In all years of study, waterfowl populations on the Keokuk Pool were low until mid-October when the scaup began to arrive. The scaup population built rapidly, reached its peak in early November and then declined (Figure 2). Canvasbacks increased slowly at first but became abundant during late October and early November. Canvasback peak populations occurred later than did peak scaup populations, but large numbers of canvasbacks were present on the Keokuk Pool from late October to mid-December (Figure 2).

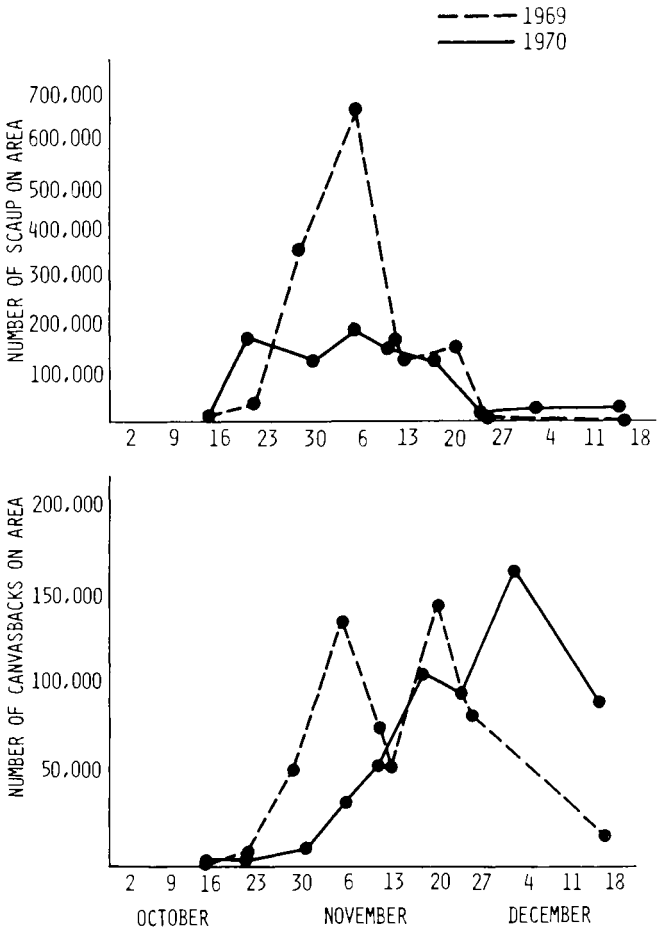

Figure 2. Number of scaup and canvasback using Keokuk Pool in 1969 and 1970.

During the two years of this study, the mallard (*Anas platyrhynchos*) population on the study area differed markedly. In 1969 mallard numbers on the study area fluctuated greatly throughout the migration. In contrast, the population remained at a low level during 1970 until early December.

Daily Movements

In 1969, many birds arrived before the hunting season opened and used the upper and middle sections. After hunting began, a pattern of daily movement evolved in which diving ducks left the upper two sections each morning and moved into the less disturbed lower section to spend the day (Thornburg, 1970). This pattern differed only slightly in 1970. Because of the early opening of the duck season, few diving ducks were present when the season began. When the scaup and canvasbacks first arrived on the study area they settled in the middle section and remained there until disturbance forced them into the lower section. This was well illustrated by a large flight of diving ducks which migrated into the middle section of the Keokuk Pool on November 2 and 3. Hunting pressure was light that week and the birds remained scattered throughout the middle section. During the weekend of November 7 and 8, however, every blind in the middle section was occupied by hunters. This heavy hunting pressure and continuous disturbance by boats prompted the establishment of a pattern of daily movement into the lower section.

Distribution of Hunters

The distribution of hunters in 1969 and 1970 was similar, but the number of blinds built increased in 1970. In 1969, 87 duck blinds were built on the study area. The number of duck blinds on the Keokuk Pool increased to 101 in 1970, probably because of increased bag limits, an extended season, and preseason predictions of large fall flights of ducks. Most blinds on the study area were erected in backwater areas by hunters hoping to shoot mallards. A few hunters, however, preferred to shoot diving ducks and built open water blinds. In 1969, 29 open water blinds were constructed, and this number rose to 45 in 1970. Thompson (1969) reported about 25 open water blinds in 1967.

Hunting Seasons

In 1969, the regular duck season for both Illinois and Iowa was 30 consecutive days with a daily bag limit of four ducks. The bag could not include more than one canvasback or one redhead (*Aythya americana*), two mallards, and two wood ducks (*Aix sponsa*). In addition to the basic bag, there was a provision for "bonus" scaup in both states whereby hunters downstream from the Fort Madison bridge were permitted to take six ducks per day as long as at least two of the six were scaup. This "bonus" scaup season ended November 16 in both states in an effort to protect canvasbacks which presumably migrated later. The duck season in Iowa extended from October 25 to November 23, and from November 1 to November 30 in Illinois. Shooting hours started one-half hour before sunrise in Iowa and at sunrise in Illinois (U.S. Department of the Interior, 1969).

For the 1970 duck season, Illinois and Iowa were selected as the test areas in the Mississippi flyway for the experimental point system. Both states were given a 55 day continuous season with a bag limit of 100 points per day. Iowa's season was from October 3 to November 26, and the Illinois season lasted from October 17 to December 10. Shooting hours were from sunrise to sunset in both states (U.S. Department of the Interior, 1970).

The justification for the point system was based on the hypotheses that there was an excessive number of drakes in some species which were not contributing to annual production (Bellrose, Scott, Hawkins, and Low, 1961), that some species could withstand more shooting than they had received in the past (Crissey, 1965), and that this system encouraged hunters to learn in-flight duck identification but did not require it. Under the point system, a hunter could shoot until the last bird he bagged caused the point count of his bag to reach or exceed 100 points. Different species and sexes of ducks were assigned varying point values. The daily limit on coots was 15, and five geese could be taken each day but only one of the five could be a Canada goose (*Branta canadensis*).

Both Illinois and Iowa held nine day September teal seasons in 1969, but only Illinois had an early teal season in 1970. The 1970 Illinois teal season ran from September 19 to 27.

Hunting Techniques

Various hunting techniques are used on the Keokuk Pool. The most popular form of hunting on the area is from blinds and with decoys. A few hunters, especially on opening weekend, wade the wooded backwaters and jump-shoot mallards

and wood ducks. Sculling is practiced by a few hunters. This is done with a small, low boat which is propelled by a single, long oar extended from the rear of the craft. These hunters concentrate on geese and mallards. The goal is to scull the boat into shooting range of a flock of waterfowl.

Hunting Pressure

It is estimated that in 1970, 3,788 man-days were spent hunting ducks from blinds on the Keokuk Pool. A man-day equals one hunter hunting during any part of one day. This estimate is based on reports from 52 blinds which indicated that a total of 1,934 hunters participated in 696 separate hunts. Again assuming these hunters were representative of all hunters on the area, the figures were expanded on the basis of 101 blinds on the study area to give an estimate of man-days of hunting on the Keokuk Pool. No data on man-days of recreation were collected in 1969.

Intensity of hunting was classed as light to moderate during the week and heavy on weekends. The overall picture of hunting can be described as intense on opening weekend with a subsequent drop as the season progresses.

Evaluation of Harvest

Daily hunting record sheets were used to determine waterfowl kill on the Keokuk Pool. This technique required minimal effort on the part of the hunters and allowed maximal coverage of the study area. Bag checks were used in an attempt to evaluate the accuracy of the hunting record sheets. In 1969, only five bag checks were made which could be compared to the record sheets, and there was one instance in the five in which a hunter failed to record his kill. It was possible to make 21 bag checks in 1970 which could be used for comparisons. Two cases were found in the 21 in which ducks were killed but the day's kill was not reported on the record sheets. Because it was usually not possible to bag check entire hunting parties, there was no way to compare waterfowl identification on the daily hunting records with information from bag checks.

Hunting party observations and bag checks were not used in the harvest calculations. These techniques were discarded as a means of appraising bag composition because the long distances required in observing hunting parties made it impossible to identify shot birds and there was no way to determine what percentage of the total kill was checked during bag checks.

The 1969 goose season began before hunters could be contacted, and the reported goose kill estimates in Table 2 are low. However, the figures do show species composition.

In 1969 all data were collected during the regular duck season. Table 2 gives a summary of the 1969 harvest. Usable data were gained from 48 blinds with a reported total bag of 2,443 waterfowl. The average number of birds bagged per blind was 51. By multiplying this average by the number of blinds on the area an estimated bag of 4,437 birds is reached. Total estimated waterfowl harvest for 1969 on the Keokuk Pool was 5,616 birds. Cripples lost numbered approximately 1,179 waterfowl.

Total kill reported from 55 blinds for the goose and regular duck seasons in 1970 was 3,373 waterfowl. Multiplying the average of 61 birds per blind times 101 blinds produces an estimated bag of 6,161 birds. Crippling loss was estimated to be 1,636 birds for an estimated total kill of 7,797 waterfowl. Table 2 shows the harvest for each species for the 1970 season. Figure 3 compares weekly kills in 1969 and 1970.

TABLE 2. REPORTED KILL ON THE KEOKUK POOL, 1969 AND 1970

	1969		1970	
	Kill	% of Total	Kill	% of Total
Mallard	755	30.91	1082	32.08
Scaup	573	23.46	616	18.26
Canvasback	219	8.97	110	3.26
Coot	170	6.96	302	8.95
Goldeneye	124	5.08	82	2.43
American Widgeon	93	3.81	129	3.82
Redhead	64	2.62	60	1.78
Blue-winged Teal	60	2.46	284	8.42
Green-winged Teal	59	2.42	178	5.28
Gadwall	52	2.13	43	1.27
Ruddy Duck	44	1.81	50	1.48
Shoveler	40	1.64	22	.65
Ring-necked Duck	38	1.56	60	1.78
Bufflehead	33	1.35	43	1.27
Canada Goose	26	1.06	30	.89
Pintail	26	1.06	67	1.99
Wood Duck	18	.73	113	3.35
Common Merganser	12	.49	11	.33
Hooded Merganser	9	.36	5	.15
Black Duck	6	.24	5	.15
Blue Goose	4	.16	28	.83
Surf Scoter	4	.16	4	.12
White-winged Scoter	4	.16	4	.12
Red-breasted Merganser	2	.08	0	.00
Lesser Snow Goose	0	.00	14	.42
Oldsquaw	0	.00	3	.09
White-fronted Goose	0	.00	2	.06
Other	8	.32	26	.77
TOTAL	2443	100.00	3373	100.00

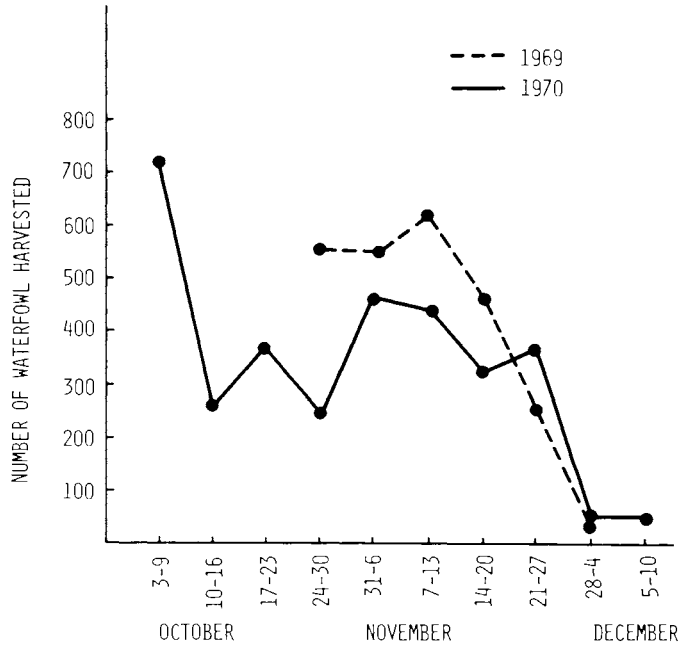

Figure 3. Number of waterfowl harvested weekly in 1969 and 1970.

A total of 142 ducks was checked while making bag checks during the 1970 Illinois teal season. Combining this total with the additional reported teal kill from cooperating Illinois hunters indicated that a minimum of 218 ducks were harvested on the Keokuk Pool during the 1970 Illinois teal season.

Because it is not known what proportion of the total 1970 teal kill is represented by the data from the Illinois teal season and it was not possible to collect data for the 1969 teal seasons, these data are neither used in Table 2 nor in estimating total kill for the Keokuk Pool.

Selectivity in Shooting

During conversations with Keokuk Pool hunters, most of them indicated that they preferred to shoot mallards and canvasbacks. However, few actually selected for these species. Bag checks and hunting-party observations indicated that most hunters were indiscriminate in shooting; they shot at whatever decoyed to their blind. Fewer than six parties on the study area consistently selected highly prized ducks.

The point system in effect in 1970 produced greater selectivity than was observed in 1969. Most hunters tried to shoot drake mallards rather than hens, and several reported letting wood ducks and canvasbacks pass without firing in hopes of getting to shoot a larger number of ducks of lower point value.

The ability of hunters to selectively shoot scaup was tested in 1969 with the "bonus" scaup regulations. Duck hunting on the Keokuk Pool was generally poor in 1969. The birds remained in large flocks and did not decoy well enough to permit the shooting of scaup. Analysis of 1969 daily hunting records indicate that fewer than 50 "bonus" scaup were taken by hunters. The effect of the "bonus" scaup season on other species is unknown, but such regulations on the Keokuk Pool could increase the kill of ring-necked ducks and canvasbacks because of the large number of these species present during the late October and early November season.

DISCUSSION

Harvest

This study indicates that hunting takes only a small portion of those waterfowl using the Keokuk Pool each fall, and that hunting is not a major threat to any particular species which uses the area.

Approximately 8,700 waterfowl were harvested on the Keokuk Pool in 1970. In 1969 approximately 7,100 waterfowl were harvested. Mallards comprise over 30 percent of the waterfowl kill on the area (Table 2). Scaup and canvasbacks are of special importance because of their great concentrations on the pool during spring and fall. Scaup furnish about 20 percent of the annual kill (Table 2). The kill of canvasbacks is much lower: 8.97 percent in 1969 and only 3.26 percent in 1970 (Table 2). This variation may indicate selection against canvasbacks in 1970 because of their high point value.

Green (1963) reported that during a 15 year study of waterfowl harvest on the Upper Mississippi River Wildlife and Fish Refuge and the Mark Twain National Wildlife Refuge, mallards made up 49.77 percent of the total calculated kill on those two areas. Scaup comprised 2.86 percent of the kill, and canvasbacks represented only .77 percent of the total. The differences between these percentages and those found on the Keokuk Pool reflected the dissimilar physiography and population composition of the areas. The two refuges in Green's study were more marsh-like with extensive back-water areas, and mallards were much more abundant than were diving ducks. On the Keokuk Pool, relatively few backwater areas were present and diving ducks greatly outnumbered dabbling ducks.

The decline in canvasback numbers during the last 15 years has been of much concern to waterfowl biologists. This has led to restrictive shooting regulations and suggestions of closing canvasback concentration areas within the United States to all waterfowl hunting. Geis (1959) estimated that, nationally, hunting removes more than one-half of all flying canvasbacks each year. It was feared that an excessive number of canvasbacks were being taken on the Keokuk Pool, but, fortunately, this was not the case. Canvasbacks sit in large flocks and are usually not attracted to decoys around blinds. Bellrose (1944) suggested that there is a lower percentage of those present killed when ducks are present in large concentrations than when populations are low. Olson (1965) found that small flocks of canvasbacks are more susceptible to hunting mortality than are large flocks. This behavioral trait and the large canvasback population are probably responsible for keeping canvasback kill low on the Keokuk Pool.

The loss of crippled birds is an important consideration in the study of waterfowl harvest. It was difficult to appraise the crippling loss on the Keokuk Pool because the number of ducks hunters reported knocking down but not retrieving was believed to be much too low, and the large size of the area made it impossible to directly observe crippling losses. Hochbaum (1947) reported crippling loss in diving ducks on Delta Marsh to be equal to the number of birds in the bag. I do not believe the number of unretrieved cripples is this great on the Keokuk Pool. On the Keokuk Pool, ducks usually fall in open water far from vegetation and, unless the water is rough, most of the birds are retrieved. From my observations, I believe crippling loss on the study area comprises no more than 20 to 30 percent of the total kill.

Harvest Systems

The timing of the 1969 "bonus" scaup season was set up under the premise that relatively few waterfowl which could be confused with scaup would be present on the Keokuk Pool during the special season. Data indicated that this situation existed in some places (Crissey, 1965), but this was not the case on the Keokuk Pool. Large numbers of both canvasbacks and ring-necked ducks were present during the bonus season, but the effects of the "bonus" scaup regulation on canvasbacks and ring-necked ducks could not be determined.

The scaup bonus was established because it was felt that the species could withstand more shooting (Crissey, 1965), and thereby increase the opportunity for waterfowl hunting. Fewer than 50 "bonus" scaup were taken in 1969 on the Keokuk Pool. With such a small increase in scaup harvested, it is questionable whether such seasons can be justified when large concentrations of canvasbacks and ring-necked ducks are present.

The point system was experimentally adopted in 1970 with the hope that it would provide a positive approach to species management. There was a built-in incentive to learn in-flight waterfowl identification while at the same time it

permitted the utilization of ducks which were killed before being recognized. Hunters on the Keokuk Pool were enthusiastic about the new system and were anxious to learn in-flight duck identification. They followed the rules of the system better than was expected, and no incident of discarding ducks was reported.

Management Recommendations

1. There appears to be no need for an inviolate refuge on the Keokuk Pool at present because large areas used by ducks are relatively undisturbed. However, refuge status might provide control over future developments and pollution.

2. There is no reason to close the Keokuk Pool to waterfowl hunting. The percentage of birds present which are killed is low. Most hunters on the area can identify canvasbacks in flight and, if necessary, the canvasback season could be closed while still allowing the hunting of other species.

3. Because of the new point system there is little advantage in having special scaup seasons on the Keokuk Pool. There is much overlap between ring-necked duck and scaup migrations, and such regulations could significantly increase the kill of ring-necked ducks.

4. A pollution control monitoring system should be established on the Keokuk Pool. If the fingernail clam population is lost, much of the value of the area to ducks will be lost also.

5. Investigations should be initiated to determine how dredging or water level manipulation would affect the fingernail clam population.

ACKNOWLEDGMENTS

The cooperation of a number of people has made the completion of this project possible. I thank all who have contributed.

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